

Claims

1. A thrust converter comprising:
reciprocating movement means;
reciprocation-rotation conversion means for converting reciprocating movement of the reciprocation movement means into rotational movement;
rotation-reciprocation conversion means for converting rotational movement of the reciprocation-rotation conversion means into reciprocating movement; and
reaction-force receiving means for supporting reaction force of reciprocating movement of the rotation-reciprocation conversion means.
2. The thrust converter according to claim 1, wherein the reciprocation movement means, the reciprocation-rotation conversion means, the rotation-reciprocation conversion means, and the reaction-force receiving means are aligned in one line; and a through hole is formed to pass through the center axes thereof.
3. The thrust converter according to claim 1 or 2, wherein the reciprocation-rotation converter means comprises a first screw member to which axial thrust is imparted by the reciprocation movement means, a second screw member to be

6. The thrust converter according to claim 1 or 2, wherein the reciprocation movement means comprises a motor, a fourth screw member provided on a load-side extremity of a shaft of the motor, a fifth screw member to be screw-engaged with the fourth screw member, a third detent section for locking the fifth screw member to restrict movement to only an axial direction, and motor rotation-reciprocation conversion means for converting the rotating movement of the shaft of the motor into reciprocating movement;

the reciprocation-rotation conversion means comprises a first screw member supported by the fifth screw member to allow rotation and to prohibit axial movement by way of a second shaft bearing, a second screw member to be screw-engaged with the first screw member, and a first detent section for locking the first screw member to restrict movement to only the axial direction;

the rotation-reciprocation conversion means comprises a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member, a third screw member to be screw-engaged with the screw section, and a second detent section for locking the third screw member to restrict movement to only an axial direction; and

the reaction-force receiving means comprises a substrate, the second screw member, and a first shaft bearing for

supporting the second screw member on the substrate to allow rotation and to prohibit axial movement.

7. The thrust converter according to any one of claims 3 to 6, wherein the second detent section for locking the third screw member to restrict movement to only an axial direction is interposed between the third screw member and a first screw member.

8. The thrust converter according to any one of claims 3 to 7, wherein screw lead of the first screw member and screw lead of a second screw member to be screw-engaged with the first screw member are greater than screw lead of a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member and greater than screw lead of a third screw member to be screw-engaged with the screw section.

9. The thrust converter according to any one of claims 3 to 7, wherein screw lead of the first screw member and screw lead of a second screw member to be screw-engaged with the first screw member are smaller than screw lead of a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member and smaller than screw lead of a third

$$-\frac{\partial}{\partial t} \left(\frac{\partial \phi}{\partial x} \right) = \frac{\partial}{\partial x} \left(\frac{\partial \phi}{\partial t} \right) \quad (1)$$
[illegible]

11. The thrust converter according to any one of claims 3 to 10, wherein a main spindle shaft of a chucking apparatus corresponding to the substrate is secured to a mount frame fixed to a load-side bracket of a motor by way of a third bearing to be rotatable and not to be capable of axial movement.

12. The thrust converter according to any one of claims 4 to 11, wherein the second bearing is constituted of a double bearing.

13. A method of controlling the thrust converter as defined in claim 5 or 6, wherein a motor whose torque can be controlled through current control is used as the motor, and constant thrust is produced by constant control of the current

to the motor.

14. A method of controlling the thrust converter as defined in claim 5 or 6, wherein a motor whose torque and positions can be controlled through current control is used as the motor; and wherein the position of the motor is controlled until the motor moves to a predetermined position, and torque of the motor is controlled.

15. A method of controlling the thrust converter as defined in claim 5 or 6, wherein the position or torque of a motor of the thrust converter is corrected on the basis of a moving status of an external drive source other than a drive source of the thrust converter.

16. A method of controlling the thrust converter as defined in claim 5 or 6, wherein the position of a motor of the thrust converter is corrected on the basis of the temperature of a machine having the thrust converter provided thereon.

17. A controller for controlling the thrust converter defined in claim 5 or 6, comprising:

an input section for entering a moving status of an external drive source other than a drive source of the thrust

[illegible]
$$\begin{aligned} \left(\begin{array}{ccc} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{array} \right) &= \left(\begin{array}{ccc} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{array} \right) \\ \left(\begin{array}{ccc} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{array} \right) &= \left(\begin{array}{ccc} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{array} \right) \end{aligned}$$

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control means for controlling the position and torque of the motor; and

changeover means for which operates the motor through position control on the basis of a difference when a difference between the positional instruction and the current position is lower than a predetermined value and changes the motor to torque control when the difference between the positional instruction and the current position exceeds the predetermined value.

20. A controller for controlling the thrust converter as defined in claim 19, wherein the changeover means comprises:

current limit means for limiting a current instruction to be sent to the motor; and

means which sets a limit current value of the current limit means so as to become greater than a current instruction value based on a difference when a difference between the positional instruction and the current position is lower than a predetermined value and which sets the limit current value of the current limit means so as to become smaller than the current instruction value based on a difference when a difference between the positional instruction and the current position exceeds the predetermined value.

21. A controller for controlling the thrust converter

$$\frac{1}{\Gamma_0} \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right) = \frac{1}{\Gamma_0} \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right) = \frac{1}{\Gamma_0} \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right)$$

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